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(54) Abstract Title

A system for video, audio and graphic presentation in tandem with video/audio play

(57) The present invention is a method for the coordination and display of graphics or play out of audio or video in conjunction with a multimedia presentation. Graphics objects such as text or sprites, which may be animated, are displayed by the viewer's equipment, which is typically an advanced television or set-top box, which plays the video and audio. Graphics objects are displayed at locations which are complementary to the locations of objects in the video. Similarly, audio or video clips, stored in the set-top box, or embedded in the stream can be played at appropriate times and screen locations in the presentation called video and audio "holes". Data describing these "holes", and other control information is embedded in the video stream and extracted by the viewer's STB for use in coordinating tandem play.

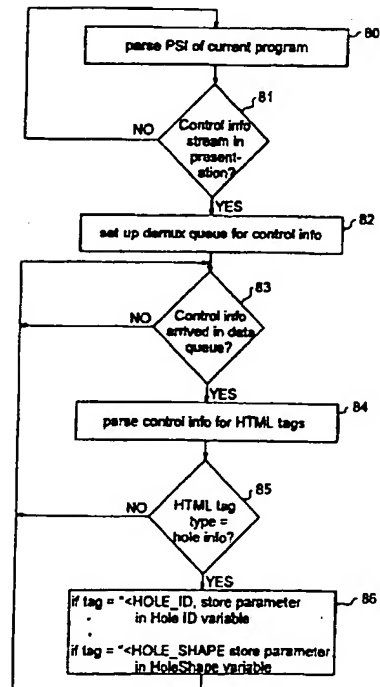
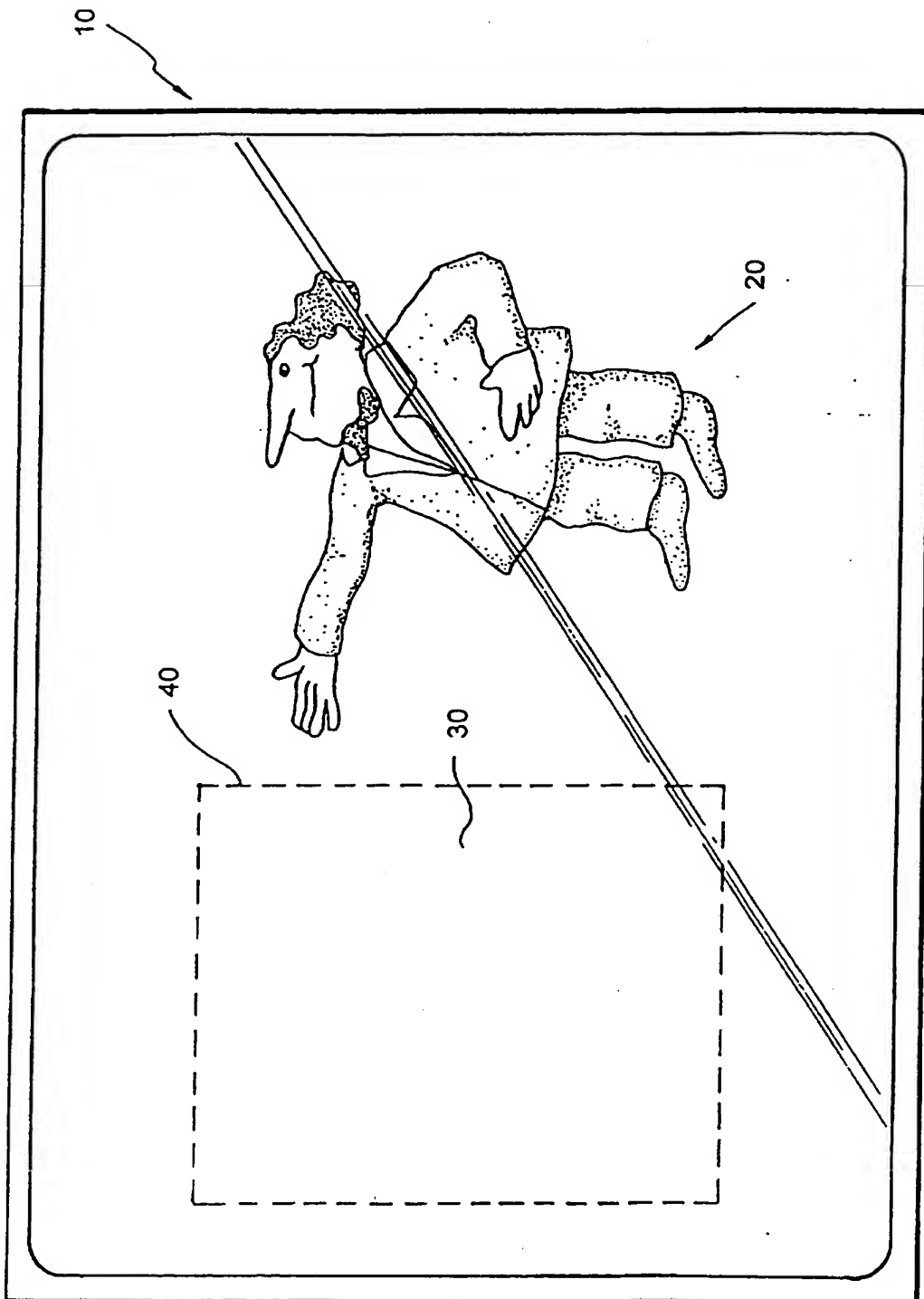
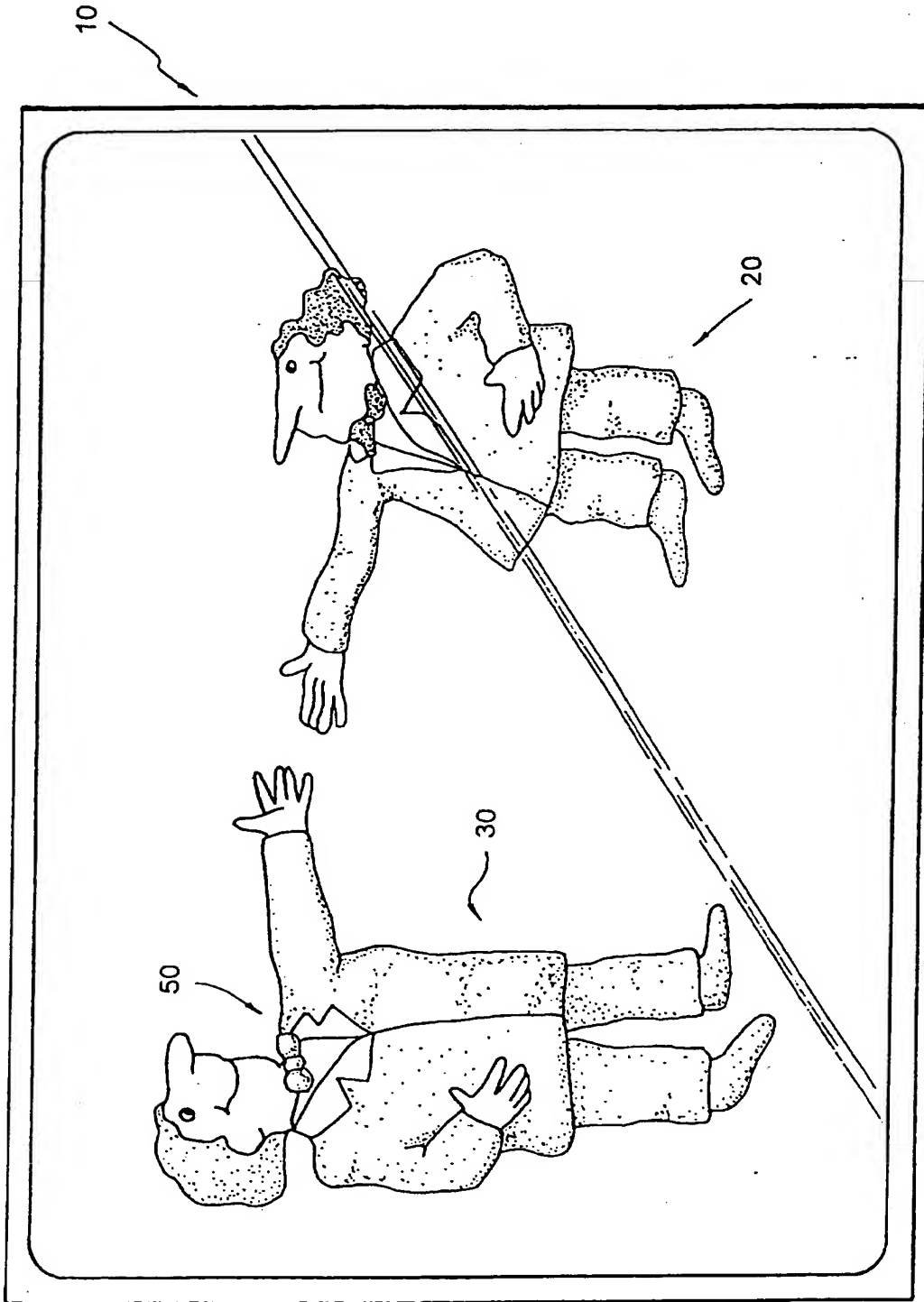


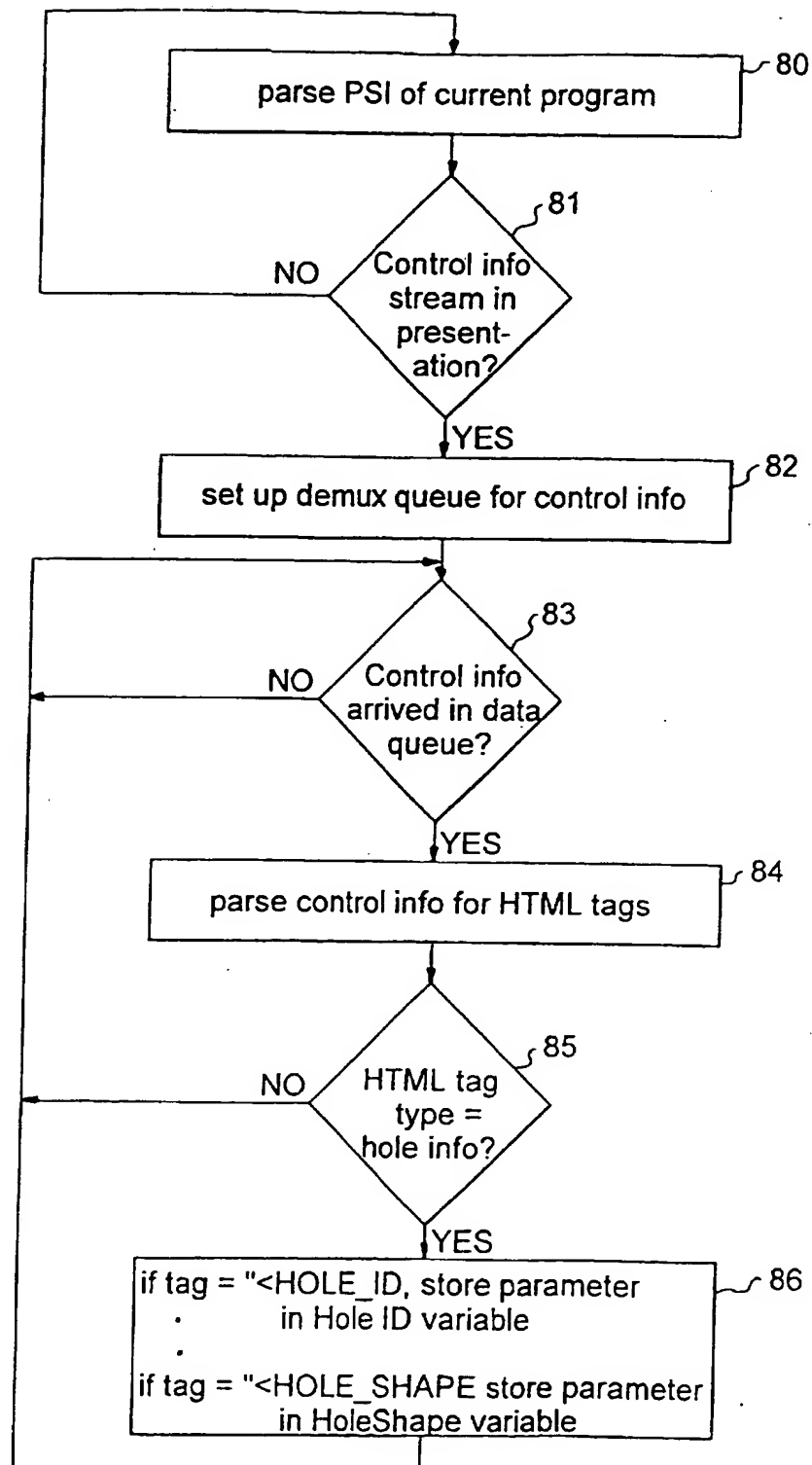
Fig. 3

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**Fig. 1**

**Fig. 2**

**Fig. 3**

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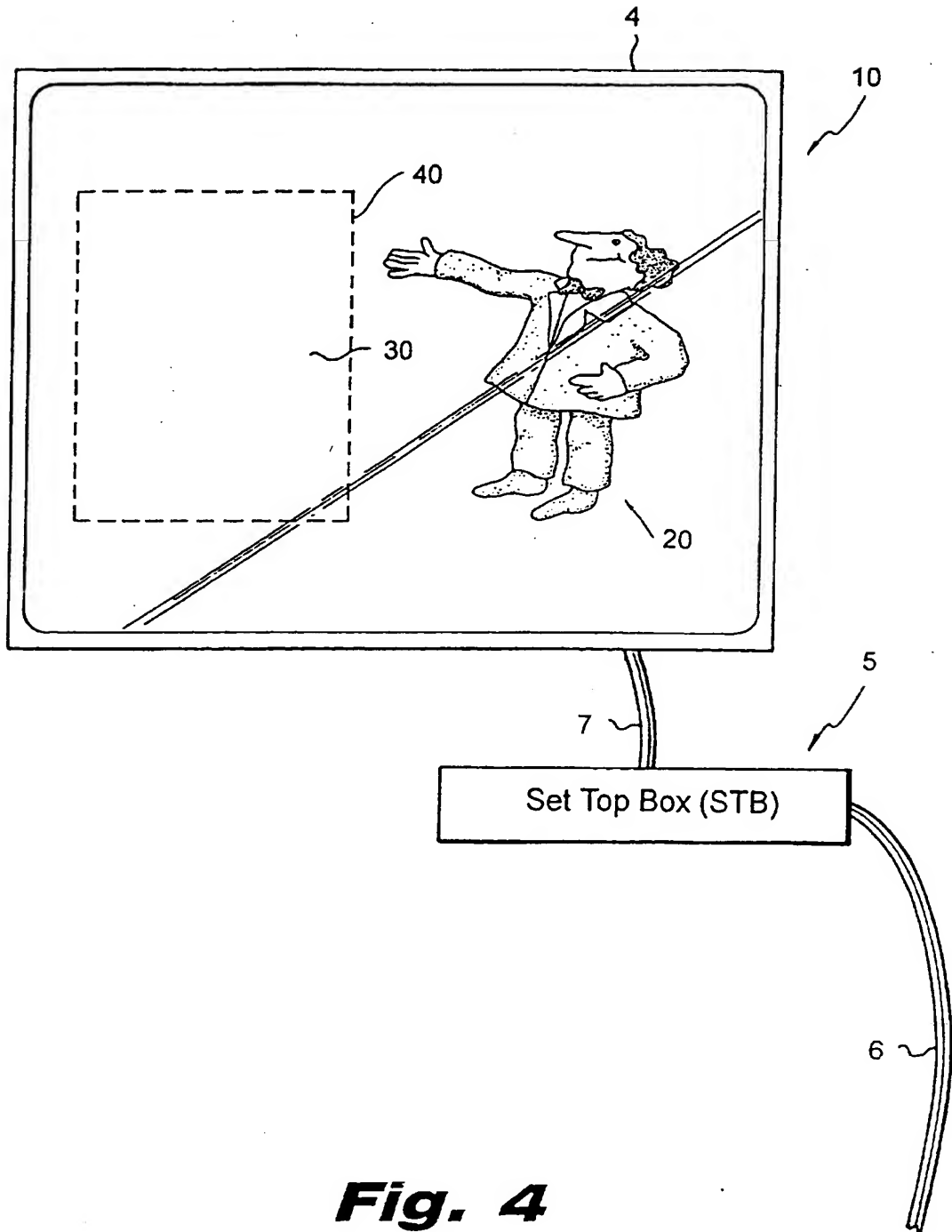


Fig. 4

**A SYSTEM FOR VIDEO, AUDIO, AND GRAPHIC PRESENTATION
IN TANDEM WITH VIDEO/AUDIO PLAY**

5 The present invention relates to displaying the content of audio, video, and graphic units in tandem with a multimedia presentation having holes indicating predefined locations and times for the display of the audio, video, and graphic units.

10 Many video applications, including interactive and multimedia applications, take advantage of the video viewer's equipment capability to display graphics overlays on the video screen such as a TV or a PC monitor. These graphics displays either dominate the entire screen, as in the case of many electronic program guides or menus, or sections thereof. The video behind these graphic overlays is entirely or
15 partially obscured, thereby interfering with the viewing experience. Systems for the presentation of electronic program guides, such as described in U.S. Patent Nos. 5,737,030, 5,592,551, 5,541,738, and 5,353,121, display these guides either on a screen devoid of video or one which uses a still frame or moving video simply as a background, with no
20 coordination between the location of items in the video and the location of graphics overlays.

 Currently, Viewers' equipment, such as set-top boxes (STB), does not have the capability to determine where objects are located in the
25 video. Determination of an object's location in a video is necessary in order to place the graphics objects, such as the on-screen text or animated characters, in locations which do not interfere with objects appearing in the video presentation.

30 Systems such as the one described in U.S. Patent No. 5,585,858 attempt to coordinate video and graphic displays by including in the broadcast stream, or pre-storing at the viewers' equipment, graphic overlay screens designed to be compatible with the video content. However, these screens must be created well in advance of the
35 presentation, and thus lack the flexibility to create and display non-interfering graphics overlays adaptively. In addition, those systems display graphics at specific "trigger points" in the presentation, not at arbitrary points throughout the presentation.

40 Other systems which add graphics or audio content to an existing presentation, such as described in U.S. Patent No. 5,708,764, require the active participation of the viewer in the process of presentation. The viewer, for example, may be required to answer a number of questions before or during the presentation, the responses are then displayed on
45 the screen at predetermined times.

Systems which allow the personalization of content for individual users are well known in the context of Web browsing. Other systems, such as systems described in U.S. Patent Nos. 5,585,858 and 4,616,327, provide a limited number of introductions, by the viewers' equipment of predetermined text or graphics. Some systems, such as described in U.S. Patent Nos. 4,839,743, 4,786,967, and 4,847,700, provide audio and/or video personalization through the selection among a small number of alternate video and audio tracks which are broadcast simultaneously. The selection is performed at the viewer's equipment.

Accordingly the invention provides a method for displaying content of audio, video, and graphic units in tandem with a multimedia presentation having holes indicating predefined locations and times for the display of said audio, video, and graphic units, the method comprising: communicating a multimedia presentation stream to a receiving device; determining if said multimedia presentation stream includes holes information embedded therein; extracting said holes information; and displaying said audio, video, and graphic units in tandem with said multimedia presentation in said holes of said multimedia presentation.

According to the preferred embodiment the location and timing of video objects and audio events are made available to the viewers' display equipment. This gives that equipment the flexibility to add non-interfering graphics or audio when and where it sees fit, in an adaptive manner throughout a presentation, rather than at limited points. This allows the viewers' equipment to create a tandem video/audio/graphics presentation without requiring viewers' active participation in the presentation process. A preferred embodiment of the present invention allows coordination of graphics content that is not pre-stored, such as broadcast news bulletins, and performs still or animated graphics overlay of video, addition or replacement of video, and audio replacement in coordination with the existing video and audio content of a presentation.

According to the preferred embodiment a system is provided for the definition and use of information which enables the display or playing of audio, video or graphics objects in tandem with the video and audio play of a digital video presentation. The presentation thus enhanced may be available via a broadcast or in a video-on-demand scenario. The video distribution system over which the video is made available can be a one-way system, such as a terrestrial television broadcast, or a two-way communication, such as a hybrid fiber/coaxial cable system with return channel capability.

According to the preferred embodiment the tandem presentation of additional audio, video, or graphics is made possible by defining video and audio holes in the video or audio presentation at which there is no significant video or audio activity. Holes are locations and times in the video presentation. Graphics or audio objects are appropriately presented by the STB in those holes. The STB is notified as to the location and/or times associated with these holes, as well as other information which characterizes the material which the STB must present.

With this information, the STB is able to judiciously place graphics objects on screen or play audio or video content, and avoid interference with video objects or audio events. The graphics objects displayed by the STB can be static or dynamic, i.e., animated. Thus, a preferred embodiment of the present invention also enables the creation of video presentations in which objects in the original video or animation interact and move in tandem with video or graphics objects which are added by the viewer's equipment. For example, a cartoon may be created in which several characters are seen on screen at once and a hole is left for the addition of an animated character which is added by the viewer's equipment such as an STB.

Alternatively, the hole could be defined at the location of a relatively less important character which can be obscured by the STB-animated character. The viewers whose STB does not support the present invention will still be able to see a presentation with no video holes. The information as to what type of character can be added, at what screen locations, at what times, and optionally, the motion of the added character is delivered to the STB in advance of the display of the character.

Similarly, a preferred embodiment of the present invention allows tandem audio play between the audio content of the presentation and audio content which is introduced by the STB.

The preferred embodiment allows for the personalization of the video, graphics or audio content introduced by the STB. The personalization is achieved by a viewer when he or she specifies several personal parameters, such as name and age through a viewer interface. To continue the above example, a child's name may be entered in the STB's personalization information. When viewing the prepared presentation, the STB-animated character can display this child's name, when this character is presented in the location of video holes. Alternatively, the STB can play an audio clip of the child's name during audio holes. Personalized audio or video clips may be recorded and stored in the STB for use in the tandem play.

Thus, a preferred embodiment of the present invention allows a single version of material such as a cartoon presentation to be created and broadcast, yet be viewed and heard differently by various viewers, and tailored to them specifically. A hybrid presentation is in effect created, the sum of the original presentation and the graphics and/or audio which is introduced by the viewers' STB into the holes.

Accordingly, personalization information, audio and video segments and possibly hole information are stored in the STB. The STB receives a multimedia presentation stream embedded with hole information. The hole information is embedded into the stream during an authoring stage, where the creator of the presentation determines the hole locations and times. That hole information is extracted on the STB, and audio and video segments and personalization information previously stored on the STB, are coordinated with the holes and displayed in tandem with the multimedia presentation.

In a further aspect, the invention provides a computer program device readable by a machine, tangibly embodying a program of instructions executable by a machine for displaying content of audio, video, and graphic units in tandem with a multimedia presentation having holes indicating predefined locations and times for the display of said audio, video, and graphic units, said program comprising: means for communicating a multimedia presentation stream to a receiving device; means for determining if said multimedia presentation stream includes holes information embedded therein; means for extracting said holes information; and means for displaying said audio, video, and graphic units in tandem with said multimedia presentation in said holes of said multimedia presentation.

In a yet still further aspect, the invention provides apparatus for defining the display of content of audio, video, and graphic units in tandem with a multimedia presentation having holes indicating predefined locations and times for the display of said audio, video, and graphic units, the apparatus comprising: means for receiving a multimedia presentation stream; means for determining if said multimedia presentation stream includes holes information embedded therein; means for extracting said holes information; and means for transferring said audio, video, and graphic units in tandem with said multimedia presentation in said holes of said multimedia presentation to a device for display thereof.

A preferred embodiment of the present invention will now be described in detail, by way of example only, and with reference to the following drawings:

Figure 1 is a view of a monitor screen displaying an animated presentation with the location of a video hole indicated.

5 Figure 2 is the view of the same screen as Figure 1, with the addition of an STB-animated character in the video hole location.

Figure 3 is a flowchart showing steps involved in extracting and processing a hole information from a multimedia presentation stream according to a preferred embodiment of the present invention.

10 Figure 4 shows equipment necessary for the extraction of hole information and display of tandem content according to a preferred embodiment of the present invention.

15 The steps necessary to prepare and to play a presentation with tandem STB video graphics display and/or audio or video play according to a preferred embodiment of the present invention include:

1. defining video and audio holes during an authoring stage and embedding them as part of control information in the presentation stream with video and audio;

2. performing personalization on viewer's STB;

25 3. delivering the presentation stream to viewer's STB;

4. extracting the control information from the presentation stream and parsing by the STB; and

30 5. displaying video and audio of the presentation stream together with graphics, audio, or video objects provided by the STB during the time and location of the holes.

AUTHORING STAGE

35 According to the preferred embodiment, in order to specify the location and time of video and audio holes, a video presentation is marked with control information. This is done offline, through the use of an authoring system designed for this marking process and described in U.S. Patent Application No. 09/032,491.

40 In an alternative preferred embodiment, the control information is added in real time to a live presentation in progress, by specifying video holes to the STB. The STB uses this information to display text associated with the program, e.g., news or a sports program, and broadcast along with the video and audio. The choice of text for display
45 can be based on personalization information already stored in the STB.

In the preferred embodiment, the authoring system accepts as input video/audio content. An author steps through the content, marking locations of video and/or audio holes. The markings thus created are used by the authoring system to create control information describing these holes, which is inserted into the video/audio content.

In the preferred embodiment, the control information takes the form of HTML tags which indicate:

1. hole identifier used to coordinate hole with insertion application.
2. hole type, e.g., video or audio,
3. beginning time of hole,
4. ending time of hole,
5. beginning screen location of hole, e.g., x, y coordinates in video,
6. ending screen location of hole e.g., x, y coordinates in video,
7. motion vector for hole movement in video,
8. description of bitmap(s) to be insert in video hole, and
9. volume level for inserted audio.

An automatic object recognition is incorporated into the authoring system to simplify the authoring process. An author specifies the initial location of a video object, e.g., a less-significant character, and its subsequent locations are detected by the authoring system, which inserts appropriate control information into the stream as the object moves.

For digital video streams, the Motion Pictures Experts Group (MPEG-2) compression for audio and video signals, and MPEG-2 Systems transport for the transport of those signals may be used. A compression method is usually applied to a video before transmission over a network because of the high bit rate requirements of digital video. In the preferred embodiment, video and audio content are compressed using MPEG-2 compression, as specified in ISO/IEC 13818-2 for video and ISO/IEC 13818-3 for audio.

The MPEG-2 standard also specifies how presentations consisting of audio and video elementary streams can be multiplexed together in a "transport stream". This is specified in the MPEG-2 Systems Specification, ISO/IEC 13818-1. The MPEG-2 Systems Specification accommodates the inclusion in a presentation's transport stream of non-video and non-audio streams, by use of "private data" streams. All transport stream packets, regardless of content, are of a uniform size (188 bytes) and format. "Program-Specific Information", which is also carried in the transport stream, carries the information regarding which elementary streams have been multiplexed in the transport stream, what

type of content they carry, and how they may be demultiplexed. In the preferred embodiment, the control information is carried in an MPEG-2 Transport Stream private data stream.

5 In the preferred embodiment, beginning and ending times for hole specification are specified in terms of the Presentation Time Stamp (PTS) of the frames where the hole appears. PTSs are typically present in every frame to every third frame, and this is sufficient for synchronization, since the frame rate for NTSC video is 30 frames/second. 10 Video holes are rectangular, and thus specified by a pair of (x, y) coordinates. Other embodiments may use more complex polygons to describe video hole shape, and require more coordinates and a specification of which polygon is to be used. The video hole movement is linear between the beginning and ending screen location. Again, more complex functions 15 may be specified in other embodiments to describe video hole movement.

DELIVERY STAGE

20 According to the preferred embodiment, the control information is expressly created to describe holes left in the video and/or audio for insertion of the content by the STB. In order to show a full presentation to those viewers whose STB does not support a preferred embodiment of the present invention, holes may actually be a default unit of video or audio content. Presentations which were not designed for a preferred embodiment of the present invention may be retrofitted to 25 accommodate it, i.e., holes may be found in the existing content areas and/or sounds which can be overlaid.

30 According to the preferred embodiment, after forming the control information, the video presentation together with such control information may be transported to the viewer's STB by being sent:

a. in the video blanking interval of an analog video signal and extracted by the viewers' equipment in a manner similar to that used for closed-caption information;

35 b. in a separate Vestigial Side Band channel;

c. within a digital video/audio stream, and extraction of embedded data is performed by the viewers' equipment in a manner similar to that used for the extraction of video or audio streams. 40

THE STB

45 Figure 4 shows typical equipment necessary for performing a preferred embodiment of the present invention. It comprises a television set or a monitor screen 4, cable 6 to receive the multimedia presentation, and the STB 5 to accept, process and to forward the resulting presentation over cable 7, to be displayed on the monitor

screen 4. MPEG-2 demultiplexers, MPEG-2 audio decoders and MPEG-2 video decoders are now widely available. The C-Cube C19110 Transport Demultiplexer, C-Cube C19100 MPEG-2 Video Decoder, and Crystal Semiconductor CS4920 MPEG Audio Decoder are examples. In the preferred embodiment, the video and audio decoders are implemented together in a single chip, such as the IBM CD21 MPEG-2 Audio/Video decoder. If not incorporated in the audio and video decoder, an intermediate IC is used at the output of the decoders to convert from digital to analog and, in the case of video, encode to the desired video analog signal format such as NTSC, PAL, or SECAM. S-video output from these IC's is optional.

In the preferred embodiment, the on-screen graphics objects which overlay video content are rendered using the on-screen display (OSD) functions of the MPEG-2 Video Decoder in the STB. These decoders vary in the sophistication of the OSD which they offer and in the application program interfaces (API) which are used to control the OSD. Individual pixels can be addressed, and bitmaps are used for many text and graphic objects. A minimum level of OSD graphics capability offers 16 colours. A preferred capability offers 256 colours and multi-level blending capability. The blending capability of the OSD allows for varying degrees of opacity for the graphics overlay.

Overlay of audio content is performed by the STB audio decoder in the case of MPEG audio or by the STB processor utilizing an API to a media player. File formats supported by this player include ".wav", ".rmi", and ".mid". Alternatively, the audio playing function can be incorporated into the STB's application itself.

Video replacement or addition can be performed by an additional video decoder in the STB. Systems with "picture-in-picture" capability can use this feature for addition or replacement of video objects.

In either case, the audio being played is mixed with or pre-empts the original audio of the presentation, utilizing the STB's audio output. In another embodiment, one in which two tracks of audio are available, one for music and one for dialogue, the STB replaces the content of the latter track while allowing the former to continue as usual.

According to the preferred embodiment, the presentation, which is to be viewed, is broadcast using the NTSC or PAL for analog or ATSC or DVB for digital television standards. In another embodiment, the presentation is viewed and controlled on a per-users basis, as with a video-on-demand systems or viewing from a video tape.

The processing power needed to implement a preferred embodiment of the present invention can be easily accommodated by the processing

capabilities of the processors in most current STB's, which start at roughly 1 MIP. This processor runs the video/audio content insertion application, and controls the use of the OSD and audio functions.

5 An STB 5 typically has between 1 and 4 MB of RAM. The program of a preferred embodiment of the present invention is downloaded to or stored in the RAM of the STB, and occupies approximately up to 0.5 MB.

10 Only a small amount of the STB 5 storage is required to store personalization information for all viewers in a household. In the preferred embodiment, personalization information for each viewer includes:

1. name,
2. age,
- 15 3. content restrictions, e.g., PG-13,
4. text preference, e.g., large type,
5. enable audio replacement,
6. enable video replacement, and
- 20 7. pointer to sprite associated with viewer.

This information is stored in non-volatile memory in order to persist when the viewers' STB is powered off or during power failures. Typical STB's have non-volatile RAM for this purpose.

25 Figures 1 and 2 provide example screen displays according to a presentation prepared initially for a tandem play. Figure 1 shows a screen 10 of an animated program with one video character 20. The location of a hole 30 is indicated by dotted lines 40. The dotted lines 40 around the hole 30 are only illustrative, and would not appear in the actual program. Control information concerning the location of the hole 30 is embedded in the video stream and extracted by the STB.

30 Figure 2 shows the same screen with the addition of an STB-animated character 50 which is displayed in the location of a hole 30. Alternatively, the STB could have used the hole 30 for display of graphics text describing the character, for example.

40 It is also possible to prepare for a presentation utilizing a mechanism that looks for locations of holes 30 which occur naturally in the audio and video presentation. Alternatively, holes 30 may be created in a presentation by blanking out sections of the existing audio track or obscuring sections of the video screen.

45 The logical flow of the application which is loaded into the STB and used to parse control data of the video presentation stream and to display information stored in the STB in the holes 30 of the

presentation, is shown in Figure 3. According to the preferred embodiment, the Program Specification Information (PSI) of the current presentation is parsed at step 80. A determination is made at step 81 whether any control information with holes locations will be arriving with this presentation. If the information will not be arriving, the program control returns to step 80, and the next presentation will be parsed. If the information will be arriving, then at step 82 demultiplexer queues are setup to receive it. At step 83, a determination is made whether the control data has arrived in demultiplexer queues, if not, the test at step 83 is repeated. When the information has arrived at the queues, it is parsed at step 84 to ascertain the HTML tags. At step 85 the HTML tags are matched with the hole information. If there is no match, the program control returns to step 83. If there is a match, step 86 assigns the received data to associated variables, and returns program control to step 83.

When all the information about holes and the overlay information is parsed and assembled in the STB, then it becomes a straight forward, commonly known task of the STB to overlay content at given hole coordinates with overlay data while displaying the presentation stream on a video monitor. A similar process applies to audio holes.

A preferred embodiment of the present invention relating to the display of graphics objects such as text or sprites overlaying a multimedia television presentation, and more specifically to the display of animated graphics or play out of video or audio coordinated with a multimedia presentation, has been described herein.

CLAIMS

5 1. A method for displaying content of audio, video, and graphic units in tandem with a multimedia presentation having holes indicating predefined locations and times for the display of said audio, video, and graphic units, the method comprising:

communicating a multimedia presentation stream to a receiving device;

10 determining if said multimedia presentation stream includes holes information embedded therein;

extracting said holes information; and

displaying said audio, video, and graphic units in tandem with said multimedia presentation in said holes of said multimedia presentation.

15 2. The method of claim 1, wherein said audio, video, and graphic units are stored in said receiving device;

20 3. The method of claim 1, wherein said audio, video, and graphic units are communicated with said multimedia presentation.

4. The method of claim 1, 2 or 3, wherein said holes information is determined and embedded in a multimedia presentation stream in an authoring step prior to the communication step.

25 5. The method of any preceding claim wherein said holes information is allowed to be altered in said receiving device via a user interface.

30 6. The method of any preceding claim, wherein said holes information includes: an identifier for coordination with insertion application, media type, beginning time, ending time, beginning screen location, ending screen location, motion vector for movement in video, description of a bitmap if said video is to be inserted, and volume level if audio is to be inserted.

35 7. The method of any preceding claim, wherein said holes information is defined in such a way that displaying of said audio, video and graphics units will not interfere with viewing of said multimedia presentation.

40 8. The method of any preceding claim, wherein said holes information is defined in coordination with visible objects in said multimedia presentation.

45 9. The method of any preceding claim, wherein said holes information is defined in such a way that audio play can be performed without interfering with the sound of said multimedia presentation.

10. The method of any preceding claim, wherein said holes information is defined in such a way that audio units can be introduced in coordination with the audio units of said multimedia presentation.

5 11. The method of any preceding claim, wherein said holes information is used in displaying said audio, video, and graphic units in such a way as not to interfere with the viewing or hearing of said multimedia presentation.

10 12. The method of any preceding claim, wherein said holes information is used in displaying said audio, video, and graphic units which are coordinated in content with an audio, a video and a graphic units of said multimedia presentation, forming a hybrid of coordinated presentation from the conjunction of said multimedia presentation content and content
15 of said audio, video, and graphic units.

13. The method of any of claims 5 to 12, wherein personalization information is stored in said receiving device via said user interface.

20 14. The method of claim 13, wherein said personalization information includes: said viewer's name, said viewer's age, content restriction for said viewer, text preference, audio replacement enablement switch, video replacement enablement switch, and a pointer to a sprite associated with a viewer.

25 15. A computer program device readable by a machine, tangibly embodying a program of instructions executable by a machine for displaying content of audio, video, and graphic units in tandem with a multimedia presentation having holes indicating predefined locations and times for
30 the display of said audio, video, and graphic units, said program comprising:

means for communicating a multimedia presentation stream to a receiving device;

35 means for determining if said multimedia presentation stream includes holes information embedded therein;

means for extracting said holes information; and

means for displaying said audio, video, and

graphic units in tandem with said multimedia presentation in said holes of said multimedia presentation.

40 16. The computer program device of claim 15, wherein said audio, video, and graphic units are stored in said receiving device.

45 17. The computer program device of claim 15, wherein said audio, video, and graphic units are communicated with said multimedia presentation.

18. The computer program device of claim 15, 16 or 17, the program further comprising:

authoring means for determining hole information and for embedding said hole information in a multimedia presentation stream prior to the communication of said multimedia stream to a receiving device.

19. The computer program device of any of claims 15 to 18 wherein said holes information is allowed to be altered in said receiving device via a user interface.

20. The computer program device of claims 15 to 19, wherein said holes information includes: an identifier for coordination with insertion application, media type, beginning time, ending time, beginning screen location, ending screen location, motion vector for movement in video, description of a bitmap if said video is to be inserted, and volume level if audio is to be inserted.

21. The computer program device of any of claims 15 to 20, wherein said holes information is defined in such a way that displaying of said audio, video and graphic units will not interfere with viewing of said multimedia presentation.

22. The computer program device of claims 15 to 21, wherein said holes information is defined in coordination with visible objects in said multimedia presentation.

23. The computer program device of any of claims 15 to 22, wherein said holes information is defined in such a way that audio play can be performed without interfering with the sound of said multimedia presentation.

24. The computer program device of any of claims 15 to 23, wherein said holes information is defined in such a way that audio units can be introduced in coordination with the audio units of said multimedia presentation.

25. The computer program device of any of claims 15 to 24, wherein said holes information is used in displaying said audio, video, and graphic units in such a way as not to interfere with the viewing or hearing of said multimedia presentation.

26. The computer program device of any of claims 15 to 25, wherein said holes information is used in displaying said audio, video, and graphic units which are coordinated in content with an audio a video and a graphic units of said multimedia presentation, forming a hybrid of

coordinated presentation from the conjunction of said multimedia presentation content and content of said audio, video, and graphic units.

5 27. The computer program device of any of claims 19 to 26, wherein personalization information is stored in a receiving device via said user interface.

10 28. The computer program device of claim 27, wherein said personalization information includes: said viewer's name, said viewer's age, content restriction for said viewer, text preference, audio replacement enablement switch, video replacement enablement switch, and a pointer to a sprite associated with a viewer.

15 29. Apparatus for defining the display of content of audio, video, and graphic units in tandem with a multimedia presentation having holes indicating predefined locations and times for the display of said audio, video, and graphic units, the apparatus comprising:

 means for receiving a multimedia presentation stream;

20 means for determining if said multimedia presentation stream includes holes information embedded therein;

 means for extracting said holes information; and

 means for transferring said audio, video, and graphic units in tandem with said multimedia presentation in said holes of said multimedia presentation to a device for display thereof.

25



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Claims searched: All

Examiner: R. F. King
Date of search: 6 April 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): H4F[FGG, FGH, FBB]

Int Cl (Ed.7): H04N005/265, H04N005/272

Other: ONLINE: EPOQUE.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
	NONE	

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